

GREEN SUPPLY CHAIN PRACTICES FOR ENVIRONMENTAL SUSTAINABILITY: A PROPOSED FRAMEWORK FOR MANUFACTURING FIRMS

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ABSTRACT

The objective of this paper is to conceptualize a structural model of Green Supply Chain practices by the organizations for environmental sustainability through the identification and incorporation of relevant performance drivers and barriers of green practices. The review of the literature was done to study the Green Supply Chain practices implemented by various organizations. Further, how Green Supply Chain Management drives environmental sustainability was studied. The green performance drivers and the barriers were identified by studying the existing studies on the efficient use of green practices in Supply chain management. In this study, the scope is determined by centring on the manufacturing examples of green supply chain management. Based on the drivers and the barriers identified, a suggestive set of activities is modelled that can be used for the efficient use of the green practices in Supply Chain. Real-time organizational cases were identified that collaborated with the environmental organizations for green initiatives. This motivated the researcher to incorporate collaborations as a major suggestive parameter in the model. As this study swotted the past works of green practices for the manufacturing firms and firms in general, the suggestive components can be limited at the execution level for the service sector.

This research study is an endeavour to comprehend how Green Supply Chain Management drives environmental sustainability through secondary data. A model that is anticipated at the end of this study is completely theoretical and conceptual, and accommodates the scope of change for the change in the organization.

KEYWORDS: Environmental Sustainability, Green Supply Chain, Eco-Labeling, Product Development & Cross-Sector Collaboration

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INTRODUCTION

Environmental Sustainability

A single global market for the organizations has increased the global competition. To sustain in this competition, the organizations are striving hard to optimize its resources to improve the quality of products and the services. Major of these resources are directly or indirectly derived from nature. As the resources are becoming more limited for use, it has become difficult to acquire more resources by least exploiting the nature. Hence, Energy that is extracted from these resources is also becoming limited and needs to be optimally and smartly consumed. This has given rise to the concept of green practices by many of the organization. Organizations as a part of their social responsibility activities are moving towards green practices. Further, the regulatory pressures to

the organizations have increased in the recent past to keep a balance between the economic and environmental performance.

Additionally, since energy is said to connect things more universally than any other source, it stands at the apex of all other resources that could be contributing to sustainability. (Business Sustainability and Green Operations, 2018) Business sustainability is how a business enterprise manages and coordinates the environmental, financial and social demands of business for the business to run in the ethical and responsible manner. When sustainable business is talked of, the concept of green also follows. This is because for the business to become sustainable, it has to adopt the green practices that are coherent to the environmental standards. Sustainability can only be brought in the business executing in such a manner that the future needs are not compromised of when meeting the need of the current generation.

GREEN SUPPLY CHAIN MANAGEMENT

Supply Chain Management deals with managing the complete chain of material and information moment right from the supplier till the product or the service reaches the customers. It deals with delivering the right product to the right customer at the right time. The concept of Green in the Supply chain is seen as a recent advancement in the Supply Chain practices. This refers to all the activities being executed in a manner that it least damage the environment and support ecological balance. The activities under the Green Supply Chain are explained as under.

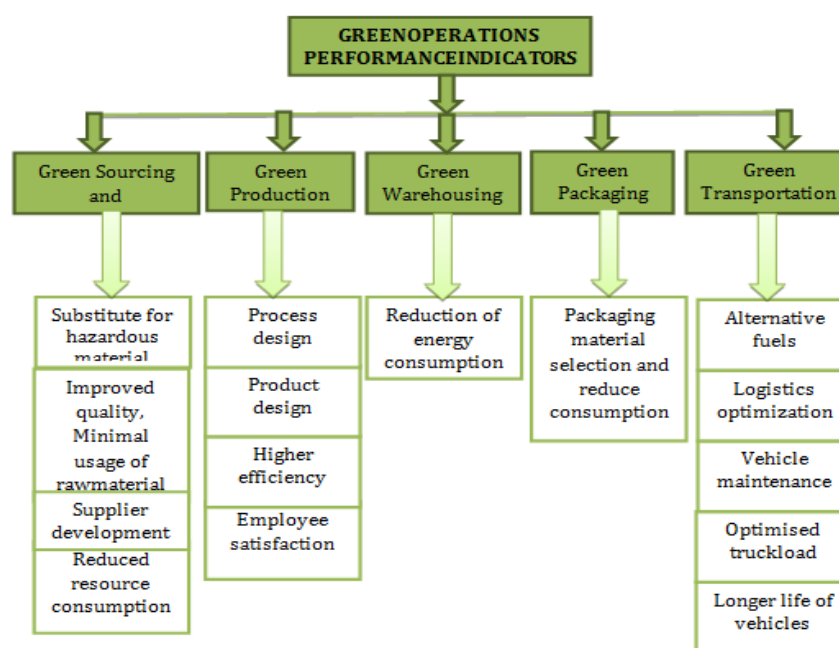


Figure 1: Green Performance Indicators Source: (Bhateja, Babbar, Singh, & Sachdeva, 2011)

Green Sourcing/ Procurement

Green Procurement or green purchasing means purchasing the product or raw material through a process that causes minimal adverse environmental impacts. It involves identifying the product or the services of high quality that provide competitive prices through environmental concerns (Green Procurement).

Green sourcing includes (Guang Shi & Koh, 2012) various green activities for any organization as:

- Organizing the seminars for suppliers and contractors for green awareness.

- Motivating suppliers to set up their own environmental programs
- Organizing suppliers meetings from the same industry for sharing their knowledge
- Informing suppliers about the benefits of cleaner production and technologies
- Pressuring suppliers to take environmental actions
- Selecting suppliers by environmental criteria
- Eco-labelling of products
- Cooperation with suppliers for environmental objectives
- Environmental audits for suppliers' internal management
- Selecting the Suppliers with ISO14000 certification

Green Product Development

Green product development means implementing the green activities in design and engineering for a new product. It includes including recycling in new product design and increasing product robustness in product design. This is aligned with developing High-performance and Low-Power Products. This can result in less electricity consumption and better serviceability of the product.

Green Manufacturing

Green manufacturing involves the use of machines and equipment for manufacturing that is energy efficient and more environmentally friendly. As for many heavy industries, the input material is the energy in the form of fuel used, that post usage emits greenhouse gases, green practices in the manufacturing ensures the limited or the optimum use of such resources. The emissions are properly disposed of or treated to least damage the environment. Further, the recycling programs for raw materials, and reusable components and also products are done to optimize the resources usage. Manufacturing firms are also implementing the product robustness in designing of the product. They are also engaged in measuring the carbon footprint.

Green Operation

All the operations that support the production process of the organization when adopting the green initiatives are called green operations. This includes the use of Information technology for data management. The procurement process, vendor rating, vendor selection, material purchase, etc all supplier related activities are tracked through IT. Usage of paper and solid resources are shifted to electronic tools.

Supply chain Activities integrated with Information technology can be seen as the best combination. Use of Computer Aided Designing and Manufacturing (CAD, CAM) can help in attaining the objective of energy conservation and environmental protection. Use of ERP systems in the operations activities can fasten the flow of information; reduce the use of paper in production and other business activities. Internet of things would aid the Supply Chain Process to avail the information, share the information at a very faster pace (Yu & Liu, 2013).

Integration of information technology with the supply chain activities is related to the organizational sustainability in terms of social, economic and environmental aspects. IT enables Supplier Relationship Management, Internal Supply Chain Management, and Customer Relationship Management can lead to the Supply Chain Sustainability in terms of Cost, Waste, Energy, Emissions (Ata, 2015).

The study ‘Green Supply Chain Management- Challenges and Opportunities’ suggested that practicing green marketing initially requires huge initial costs. Since the Green SCM encourages green products/services and operations like green technology, green energy, a huge amount of money has to be spent on the R&D programs. Further, the green initiatives may not be convincing to its customers. And hence the customers must be convinced and given awareness about the green initiatives by implementing the Eco-labelling schemes. Eco-labelling schemes offer its “approval” to “environmentally less harmless” products. The input cost to turn the setup into green would be initially high but as the benefits would be visible and expanding the green practices would be seen as a long term strategy. (Bhattacharjee, 2015).

With the increasing focus on sustainability, environmental Collaborations involving environmental NGOs and businesses are increasing. Literature is also available on the cross-sector collaborations that have shown an impact on the sustainability aspect of the supply chain activities. The environmental NGOs give equal importance to the supply chain as do the other members of the supply chain. NGOs can participate in the guiding and aiding the organizations in identifying and implementing the activities that support green initiatives. Studies show that many of cross-sector projects have been incremental towards environmental balancing and sustainability. The major focus has been on pollution prevention goals and ecosystem-centric. These efforts have been put in the day to day activities of improving the energy efficiency in facility or building, lean in manufacturing, etc. These cross-sector projects have led to improving both environmental and economic performance (Dooley, Hya, Hutson, & Jonathan, 2018).

Problem Statement and Objectives

Organizations are aware of the benefits of the green practices and are ready to invest in the endeavours those back green practices. Researches have helped them identify the drivers as Board and top management commitment, corporate social responsibility, Organizational policies. Other is listed in Table 2. Various structures (models) for the execution of green practices are also identified in the past researches. But, there is always a scope for the improvement in the suggested models. Hence, the main objective of this research is to understand and identify the chauffeurs for the Green Supply Chain Management.

REVIEW OF LITERATURE

In the field of green supply chain management, studies have been done for identifying green practices in terms of green manufacturing, green purchasing, green packaging, and green logistics. Also how environmental collaborations would aid the sustainable performance of the organization through green SCM was studied. Researchers have frequently discussed various possible gaps in their research works. Table 1 presents the summary of these literature studies with respect to the research gaps. Table 2 presents the drivers of green practices in the Supply Chain and Table 3 show the barriers to the effective implementation of green practices.

Table 1: Literature Review Representing Possible Gaps

SI No.	Author	Research Issues Addresses	Possible Gaps
1	(Trivedi & Sherma, 2017)	The author identified that the companies' studies have achieved global leadership in environmental sustainability through the simultaneous and combined application of engineering science, marketing management, green manufacturing technology	Other possible areas like supplier collaborations and cross-sectoral collaborations etc. can be further investigated.
2	(Chin, Tat, & Sulaiman, 2015)	The author proposed a conceptual model and proposed environmental collaboration as a moderator of the link between GSCM practices and sustainability performance.	The author concluded that adopting environmental practices into processes have yet to be researched fully, the proposed model needs to be researched and fine-tuned before being applied.
3	(Shi, Koh, Baldwin, & Cucchiella, 2012)	The author provided an alternative and more comprehensive conceptual framework for understanding Green Supply Chain Management in terms of natural resource-based view and its interactions with Green Supply Chain Management performance measure and Institutional drivers.	The author suggested that further research is required to develop a comprehensive, reliable and valid measurement instrument for the natural resource-based green supply chain management, the Performance model and institutional drivers.
4	(Rahim, Fernando, & Saad, 2016)	The author stated that the establishment of long-term collaborative relationships with each other is characterized by strong inter-organizational interactions, which would enable companies to pursue Green Supply Chain practices.	The study does not provide much insight as to with what types of organizations should the organization collaborate with to achieve the green.
5	(Neramballi, Sequeira, Rydell, Vestin, & Ibarra, 2017)	The author identified the main green supply chain methods as a collaboration between the various suppliers and focal firms, green practices and, monitoring performance.	Collaborations with suppliers are only stressed upon. Cross-Sector Collaborations can be investigated as the green supply chain method.
6	(Mafini & Loury-Okoumba, 2018)	The author investigated and confirmed the view that implementation of GSCM activities, namely green purchasing, reverse logistics, environmental collaboration with suppliers and green manufacturing, positively contributes to operational performance in manufacturing Small and Medium Enterprises.	The author confirmed the collaboration with suppliers as a contributor. But other possible collaborations can be investigated.

GREEN SUPPLY CHAIN DRIVERS (Derived from Literature Review)

Table 2: Drivers of Green Supply Chain Practices

Sr. No.	Research Paper Title	Author	Dominant Drivers of Green Supply Chain
1	Drivers and barriers of green supply chain management implementation in the Mozambican manufacturing industry (NIEMANN, KOTZE, & ADAMO, 2013)	W Niemann, T KotzeAdamo	<ul style="list-style-type: none"> ✓ Corporate social responsibility ✓ Organizational policies ✓ Board and top management commitment ✓ Local community

2	An Analysis Of Drivers Affecting The Implementation Of Green Supply Chain Management For The Indian Manufacturing Industries (Bhoor & Narwal, 2013)	Ram Bhoor, M.S. Narwal	<ul style="list-style-type: none"> ✓ Employees Motivation ✓ health & Safety ✓ Government Rules & legislation Environmental concerns & legislature ✓ Customers awareness, pressure & support ✓ The Scarcity of Resources, ✓ Higher waste generate on & Waste Disposal problem ✓ Investors & shareholder Pressure
3	The Drivers of Green Supply Chain Management: A Theoretical Framework (Boy & Kuruba, 2015)	Rudolph L Boy, Dr.GangappaKuruba	<ul style="list-style-type: none"> ✓ Compliance with regulation
4	A Review on Drivers and Barriers towards Sustainable Supply Chain Practices (Tay, Rahman, Aziz, & Sidek, 2015)	Mee Yean Tay, AzmawaniAbdRahman, Yuhanis Abdul Aziz, and ShafieSidek	<ul style="list-style-type: none"> ✓ Internal Drivers/ Enablers: People issues: Top management commitment, Employee involvement, Culture Strategic issues: Alignment of company strategy with purchasing/ supply strategy, Company sustainable SCM strategy, Competitive advantage, Risk management, Reputational and environmental risk, Performance management: Functional issues: Purchasing and supply function, Capabilities within purchasing and supply function, Other internal CSR practices influencing SCM ✓ External Drivers/ Enablers: Government, Competitors, Customers, Suppliers, Investors, NGOs

GREEN SUPPLY CHAIN BARRIERS (Derived from Literature Review)

Table 3: Barriers to Green Supply Chain Practices

Sr. No.	Research Paper Title	Author	Barriers to Green Supply Chain Practices
1	Drivers and barriers in green supply chain management adaptation: A state-of-art review (Dhulla & Narwal, 2016)	Sunil Dhulla, M.S. Narwal	<ul style="list-style-type: none"> ✓ Internal barriers:Lack of understanding to incorporate green buying, Inappropriate organizational structure ✓ External barriers Slack government regulation, unwillingness to exchange trade information, lack of skilled human resource ✓ Customers: Lack of demand and public awareness ✓ Competition ✓ Society ✓ Suppliers: Lack of understanding and knowledge, Poor supplier commitment, Reluctant to change, lack of understanding among supply chain stakeholders ✓ Industry Specific Barriers

2	Drivers and barriers of green supply chain management implementation in the Mozambican manufacturing industry (NIEMANN, KOTZE, & ADAMO, 2013)	W Niemann, T KotzeAdamo	<ul style="list-style-type: none"> ✓ Culture ✓ Cost ✓ Corruption ✓ Government legislations & lack of incentives. ✓ Unawareness of customers. ✓ Lack of education and knowledge ✓ Industry specific (Size of the market) ✓ Technology.
3	Barriers' analysis for implementing Green Supply Chain: a case study in Morocco (Anass & Said, 2017)	CherrafiAnass, Elfezazi Said	<ul style="list-style-type: none"> ✓ Dependent variables: Poor quality of human resources, limited use of information and communication technologies, low competition and market uncertainty as well as lack of collaboration and green initiatives. ✓ Linkage variables: Lack of organizational culture, lack of innovation and scientific research, and lack of financing mechanism. ✓ Barriers: Lack of governance and government support, unawareness of Moroccan consumers and weakness of the Non-governmental organizations, and lack of top management commitment.
4	Study of Green Supply Chain Management in the Indian Manufacturing Industries (Bhateja, Babbar, Singh, & Sachdeva, 2011)	Ashish Kumar Bhateja, Rajesh Babbar, Sarbjit Singh, AnishSachdeva	<ul style="list-style-type: none"> ✓ Green Practices being cost prohibitive. ✓ Too complicated to implement. ✓ No financial incentives to justify adopting Green SCM.

CROSS-SECTOR COLLABORATIONS FOR ENVIRONMENTAL SUSTAINABILITY

Table 4: Cross-Sector Collaborations for Environmental Sustainability

World Wildlife Fund (WWF) and The Coca-Cola Company Collaboration	(WWF and The Coca-Cola Company Announce 2016 Annual Partnership Report, 2017) (A Transformative Partnership to Conserve water, 2016)	The Collaboration helped conserve the world's freshwater resources and reduce Coca-Cola's environmental footprint.
		The collaboration is committed to tackling the natural resource challenges that impact freshwater.
		The collaboration is aiming at improving environmental performance across Coca-Cola's supply chains, integrate the value of nature into decision-making processes, and convene influential partners to help solve global environmental challenges.
ADIDAS-ARLEY	(For the Oceans) (Design with Purpose, 2017).	Parley 'for the Oceans' is an environmental organization that addresses environmental threats towards the oceans, through ocean plastic pollution.

Collaboration		The Parley A.I.R. Strategy AVOID: No to the plastic bags, microbeads and virgin plastic in the supply chain. INTERCEPT: Stop plastic before it enters the ocean. REDESIGN: Driving eco-inventions around materials, products, and new ways. New methods. The New Mindset. New Future (For the Oceans)
		Under this strategy, the partnership turns ocean plastic waste into a thread that is woven into running shoes.-
		Adidas has also created Parley swimwear, using recycled fishing nets up-cycled into a technical yarn fiber named Econyl, which offers the same properties as the regular nylon used to make swimwear.

SUPPLIERS COLLABORATION FOR ENVIRONMENTAL SUSTAINABILITY

Table 5: Suppliers' Collaborations for Environmental Sustainability

Google's Responsible Supply Chain	(Building an energy-efficient, low-carbon supply chain)	Empowered suppliers to go renewable by sourcing 100% renewable energy
		Most of the suppliers depend on a local utility grid that is dominated by coal, natural gas, and other fossil-based fuel sources
		Accomplished a combination of aggressive energy-efficiency initiatives, renewable energy purchases, and carbon offsets.
		10 years of carbon neutrality in 2016
		In 2017, matched 100% of the electricity consumption from our global operations with purchases of renewable energy from around the world.
		Google is the world's largest corporate buyer of renewable power, having procured more than 3 gigawatts of wind and solar energy
Apple Supply Chain	(Sullivan, 2018)	In 2017, 14 suppliers worked toward running the parts of their operations that serve Apple on 100% renewable energy.
		By using clean energy from renewable energy projects its suppliers avoided releasing more than 1.5 million metric tons of CO ₂ e into the air.

PROPOSED FRAMEWORK FOR THE IMPLEMENTATION OF GREEN SUPPLY CHAIN

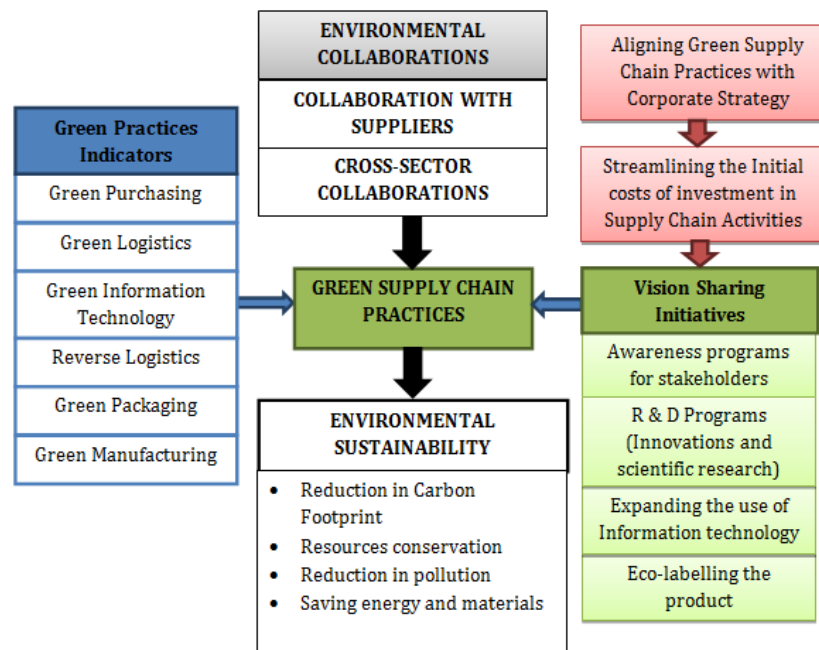


Figure 2: Proposed Framework for the Implementation of Green Supply Chain Practices

The above framework is developed at the end of this research work. It was observed that most of the organization, in general, found Green Supply Chain Management difficult to implement contributed to the high initial investment costs. Further, not aligning the Green Supply Chain practices with Corporate Strategy was also seen as a barrier. Hence, the model suggests that green practices be made mandatory at the corporate level. Aligning the organization's policies and strategies with the green initiatives followed by increasing the initial investments in the organizational level can support the Green plan.

Environmental Collaborations

Collaborating with Suppliers, cooperating with suppliers to achieve environmental objectives, improve waste reduction initiatives, new source reduction as a collaborative activity with its suppliers may help the organization achieve a green impression. Studiessuggest that for developing sustainable products or services, the firms are involved in long term supplier relationship. Majority of the firms are involved in building a strategic relationship with its suppliers, generating proper supplier solutions and calculating the performance of its suppliers. They engage in the green activities of green packaging and recycling the products for optimized resources utilization(Hasan, 2013).

Cross-Sector Collaborations means the organization engaging the government and non-government organizations in the business activities. As given the examples of Adidas with Parley Collaboration and the World Wildlife Fund with Coca-Cola Company collaboration, reduction in environmental footprint and eco-inventions are possible.

Further,aligning Green Supply Chain Practices with Corporate Strategy followed by streamlining the Initial costs of investment in Supply Chain Activities would lead to the proper alignment of the green process in the organization.

Awareness Programs for Stakeholders: Researches suggest that the awareness of the environmental sustainability by the organizations themselves is limited. It can be noticed from the results that though the industrial

companies focused more on environmental and social sustainability than economic sustainability, still are not complete (Garbie, 2015). Lack of understanding to unite green buying with the procurement process was also seen as a barrier to the implementation of green practices. The strategic advantage of green practices also made the organization reluctant to change. Hence, awareness programs for its entire supply chain stakeholder can orient the organization to the use and adoption of green initiatives.

Eco-Labeling the Product: A supply chain is never complete, if the product or the service is not made available to the customer at right time with the right information. And, to support the green initiatives the major stakeholder in the chain i.e. the customer must be made aware of the significance and importance of green practices. The only way to inform a customer of the company's green policies is through the product itself. Eco-labelling is a means to make the customer understand the environmental impact the product may have. But, the customers are not completely aware of the Eco-labels (Modak & Roy, 2014). Only 18% of customers understand Eco-labels and 36% are aware by a little extent. Hence, adopting eco-labelling and generating awareness could be supportive of the green practices.

R & D Programs (Innovations and Scientific Research): Though the concept of green supply chain management is not new, every organization's way of implementing green may be different. The type of manufacturing or service, geographic location and other various extrinsic and intrinsic factors would contribute to green initiatives. Hence, organizations R& D departments would play a major role in Innovations and scientific research for green initiatives.

Expanding the Use of Information Technology: Information Technology is seen as a major enabler of Green Supply Chain practices. Business Processes can be streamlined by proper use of IT thereby; the business processes would be executed by enabling the resource usage (Khan, Khurana, & Mannan, 2012).

CONCLUSIONS

This paper presents an amalgamated approach in the form of a model to assist the decision makers of Supply Chain Management in implementing green or sustainable initiatives. This proposed model is the combination of endeavours derived from the drivers, barriers and research gaps seen in the past studies of the manufacturing firms. The results demonstrated the collaborations with its suppliers as a major constituent to the environmental sustainability. Further, cross-sector collaboration with the environment bodies to gain eco-assistance is proposed. The results suggest that the organization should invest time and money in the awareness programs for its entire stakeholder's right from its suppliers to its customers. R & D Programs (Innovations and scientific research) would play a major role in the identification of the best green initiatives and world-class green adopters. Hence, support in terms of human resources and capital in the R& D departments is suggested further. Expanding the use of Information technology that reduces physical infrastructure for data can reduce the input resources usage. So, the right use of Information technology to optimize the resources can be done. Further, Eco-labeling the product to educate the customers, thereby convincing them for green products, can be done to support green acquaintance and further green adaption.

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